## GREGARIOUS SETTLEMENT BY PORCELAIN CRABS, *PETROLISTHES* (ANOMURA: PORCELLANIDAE)

The planktonic larvae of many marine invertebrates settle in response to specific cues (Meadows and Campbell, 1972; Scheltema, 1974), but the means by which postlarvae of decapod Crustacea identify and select appropriate habitats are largely unknown. A series of field and laboratory experiments were conducted to examine settlement patterns by megalopae of the porcelain crabs *Petrolisthes cinctipes* and *P. eriomerus*, which often display distinct, non-overlapping intertidal distributions when they co-occur. The adult vertical distributions are due to abiotic factors; sensitivity to thermal stress during aerial exposure confines *P. eriomerus* to the low intertidal, while the distribution of *P. cinctipes* is correlated with substrate composition (Jensen, 1990). These patterns are maintained in part through gregarious settlement by megalopae of both species; megalopae were induced to settle in response to caged conspecific adults transplanted above or below their normal range (Jensen, 1989). Subsequent investigations have focused on the means by which conspecific adults are located, and possible post-settlement benefits of associating with adults.

In a field experiment, adult *P. eriomerus* were confined to chambers placed beneath concrete patio blocks. These chambers were screened in a manner that prevented either tactile or visual contact by megalopae, while similar chambers without crabs served as controls. Significantly more megalopae occurred on the treatment blocks as compared to interspersed controls, suggesting that a waterborne cue is involved.

Laboratory observations revealed that contact with adults initiates a sequence of behavioural and morphological changes including a loss of forward swimming behaviour, changes in color, and degeneration of the pleopods, all features consistent with ensuing metamorphosis to first instar. *Petrolisthes cinctipes* megalopae (obtained by holding zoeae caught in plankton tows) placed individually in containers with adults completely settled within 2–4 days while those in control treatments without adults continued to swim strongly for 2 weeks; in some individuals the swimming response persisted for as long as 3 weeks (Fig. 1). This suggests an extended period of competency to settle, an important consideration since upon moulting from a zoea into the megalopa stage an individual could be anywhere from tens of metres to tens of kilometres from shore. After settlement, juveniles continue to remain intimately associated with conspecific adults for at least a year, hiding beneath them or between their legs. Clustering with adults probably reduces predation by intertidal fishes, as the megalopae of these species are relatively slow moving and do not demonstrate other defensive tactics such as burying in the substrate. In a laboratory experiment, juveniles with conspecific adults suffered significantly less predation compared to those with adult congeners or in controls with no adults.

There are indications that two species of porcellanids of the genus *Pachycheles* also behave in a similar manner (Jensen, 1990), and while adult-mediated settlement in these filter-feeding species is admittedly a special case, gregarious settlement could be widespread among deposit-feeding or herbivorous decapods. Species that are likely candidates should meet 3 criteria that are compatible with this type of selective settlement: 1) adults and juveniles occur together; 2) they should have relatively specialised habitat requirements; and 3) a minimal risk of cannibalism. Gregarious settlement could be advantageous even among potentially cannibalistic species, provided the benefits of proper habitat selection outweigh the risks, or settling postlarvae are too small to elicit attack. It is unknown to what extent the benefits of such close association with adult populations may be offset by increased intraspecific competition.

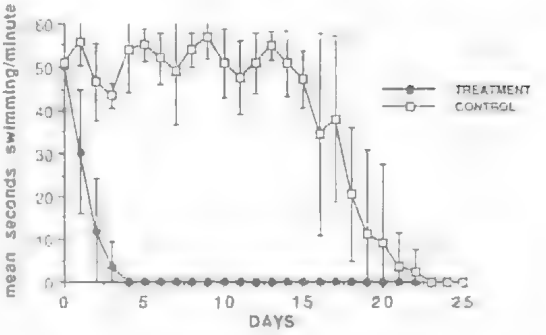


FIG. 1. Mean swimming times (seconds/minute; 1 sd) for *P. cinctipes* megalopae confined with adults (treatment) or held alone (control).

This study provides evidence of a settlement competency period for porcellanid megalopae, and subsequent benefits of gregarious settlement. More importantly, it demonstrates settlement in response to a specific cue, a widespread phenomenon in other invertebrate larvae but not previously demonstrated for decapod crustaceans.

### Literature Cited

Jensen, G.C. 1989. Gregarious settlement by megalopae of the porcelain crabs *Petrolisthes cinctipes* (Randall) and *P. eriomerus* Stimpson. Journal of Experimental Marine Biology and Ecology **131**: 223–231.

1990. 'Intertidal zonation of porcelain crabs: resource partitioning and the role of selective settlement'. Dissertation. University of Washington. 111p.

Meadows, P.S. and J.I. Campbell. 1972. Habitat selection by aquatic invertebrates. Advances in Marine Biology **10**: 271–382.

Scheltema, R. 1974. Biological interactions determining larval settlement of marine invertebrates. Thalassia *Jugoslavica* **10**: 263–296.

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